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CHANGES IN MONTHLY WEATHER REVIEW CHARTS AND SECTIONS.

Beginning with this issue four small inset charts will appear, one each on charts Nos. II, III, V, and VIII. The inset chart on No. II will give the departure of the monthly mean pressure from the normal; the inset on No. III will give the average change in pressure, increase or decrease, between the current and preceding months; the inset on chart No. V will show the departure of precipitation from the normal; the inset on chart No. VIII will show the depth of snow on the ground at end of month.

Changes in titles on Charts II and III are the adoption of the terms anticyclones and cyclones for HIGHS and LOWS, respectively. Chart No. IV will show departure of data for Canadian stations regularly hereafter, although owing to difficulties in transmission of mail reports from some of the most distant of those stations it may happen that the data may not always be complete for any given month.

In addition to the changes in charts, there is to be a monthly discussion of aerological conditions by Mr. W. R. Gregg. This discussion will appear in the section on "Weather of the Month" and will follow "Cyclones and Anticyclones." Mr. Gregg's section is to be known as "Free-air conditions."—EDITOR.

THE WEATHER ELEMENT IN RAILROADING.[1]

By GUY H. BURNHAM.

[Clark University, Worcester, Mass. Jan. 31, 1922.]

SYNOPSIS.

Railroading in every clime has important weather problems to meet and overcome, for trains and tracks have no protection against the various elements of nature. First of all, temperature extremes have a racking effect upon all steel and iron work. Rails and car wheels, exposed to such severe meteorological conditions, often break and delays sometimes result. To overcome these troubles, steel made by the open-hearth process is being used with good results.

Of the various forms of precipitation snow is regarded as the great enemy of rail transportation. Each year millions of dollars are spent in fighting the battle against snow, for windbreaks of various sorts must be erected, snowplows of different types manned and equipped, and miles of snowsheds constructed. Heavy rains bring about floods which wash away bridges, undermine roadbeds, and cause landslides. Abundant rainfall also produces luxuriant vegetation, which is a great nuisance on earth ballasted roads; for, unless cleared from the tracks, train operation is rendered difficult. Moisture also greatly reduces the life of ties and other woodwork; and to combat this effect, expensive preservative processes have to be introduced. Sleet storms and thundershowers often put electrified lines out of commission and thus create problems for the electrical engineer to solve.

Wind is an important factor in railroading, for trains are sometimes derailed by high winds. Snow and sand impelled by strong winds drift on the track, often delay transportation, and bring many difficult problems for railroad engineers to solve.

The weather affects not only the track and rolling stock of the railroad, but also the goods which it transports. This is especially true of the transportation of perishable goods in which temperature is the all-controlling factor. To regulate properly the temperature of perishable goods in transit, precooling and icing stations have been built and refrigerator and heater cars have been invented. To the efficiency of these various agencies we owe the safe transportation of many of our staple food products.

INTRODUCTION.

To the railroad man, the various phases of the weather—the rain, the sleet, the snow, the hot days, the cold days—have a significant meaning, for each brings with it special problems which have to be met and overcome. Upon the solution of these problems much depends, for the railroad is such an indispensable agent in modern life that its service must be kept up to the highest possible efficiency. In the olden days our forefathers procured life's necessities in the communities in which they lived—the town gristmill supplied the flour; clothes for the family were the product of the spinning wheel, and shoes were made from hides tanned at home. The primitive community thus was able to take care of its ordinary wants; and because of the poor means of communication then existing, but little intercourse was carried on with the outside world. As time went on roads were built between the various communities, canals were dug, rivers widened, commerce began to spring up, and the horizon of man broadened somewhat. The greatest developments along this line, however, have occurred within the last hundred years and have been mainly due to two agencies of transportation—the steamship and the railroad. To-day we look to distant lands for the sources of raw material for our factories and we talk of world markets for our goods, all of which would seem like a dream to our ancestors and which would be impossible had it not been for the application of steam as a propelling agency to land and water transportation. These two modes of transportation are now found in all parts of the world and hence the varied weather conditions which they have to face have far-reaching economic results. The problems connected with water transportation while very interesting are not so complex as those related to railroading and hence we shall confine our discussion entirely to the latter in this paper.

Although railroads are found in nearly every clime from the frozen plains of the north to the tropical jungle, their greatest developments have been reached in the temperate zones. The building of these roads, now largely a matter of history, gives us many a heroic tale of how mighty rivers were bridged, towering mountains overcome, and huge forests penetrated. To-day the story of railroading is largely one of a battle against the elements of nature to

[1] Thesis submitted in course on meteorology at Clark University.